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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	ET Docket No. 98-206
Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-band Frequency Range;	)	RM-9147
	)	RM-9245
Amendment of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the 12.2-12.7 GHz Band by Direct Broadcast Satellite Licensees and Their Affiliates; and	)	
Applications of Broadwave USA, PDC Broadband Corporation, and Satellite Receivers, Ltd. to Provide a Fixed Service in the 12.2-12.7 GHz Band	)	

TECHNICAL SUPPLEMENT TO COMMENTS
OF PEGASUS BROADBAND CORPORATION

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The purpose of this Technical Supplement is to explain and clarify the issues and recommendations contained in Section I of the Comments of Pegasus Broadband Corporation ("Pegasus"). A mitigation zone is the area near the MVDDS transmitting antenna within which DBS systems might receive harmful interference requiring mitigation. MVDDS interference will be acceptable outside the mitigation zone.

A. Operating Requirements of MVDDS Systems

In the FNPRM at Paragraph 260 the FCC seeks comment on the technical criteria needed to deploy MVDDS in the 12.2-12.7 GHz band and "[i]n particular ... comment on the technical criteria needed to deploy MVDDS so that the spectrum can be shared successfully." The sharing plan for DBS demonstrated in the interference field tests is based on MVDDS operating requirements which are different from those of other Fixed Services systems such as LMDS, MDS and fixed point to point. In particular, the proposed MVDDS operating requirements ease, but do not eliminate, the problem of sharing with ubiquitous DBS terminals which are close-in and surround an MVDDS transmitting tower. These MVDDS operating requirements are key to sharing between the two services, and consequently the MVDDS operating requirements must be part of the service rules. Otherwise, individual MVDDS operators will have no guidelines and no limitations with regard to radiation characteristics, and consequently the mitigation challenge for DBS service provider will be overwhelmingly difficult. The important point is that with the defined MVDDS operating requirements interference to close-in DBS subscribers is minimized relative to the situation where the terrestrial system had LMDS operating requirements or more conventional point to point FS operating requirements. This enables reasonable mitigation methods consistent with a low cost DBS consumer product maintained by local technicians/mechanics in which the aesthetic appearance of a consumer's residence is an important consideration.

1. E.i.r.p. and Cellularity

The MVDDS operating requirements and service rules are given in Section I and II of Pegasus' Comments. The MVDDS is proposed as a multiple cell, low power terrestrial system operating in the FS. The e.i.r.p. of the central transmitting tower and all other cellular towers in the vicinity is limited to 12.5 dBm in order to minimize the interference to ubiquitous DBS receivers. Since MVDDS systems may be built anywhere, the maximum e.i.r.p. applies to urban, suburban and rural areas. The mitigation zone distance, estimated to be of the order of kilometers, encompasses small towns and villages in rural America as well as in urban and suburban areas. Therefore, the maximum e.i.r.p. pertains to each MVDDS transmitter site, not just to the central site, and the maximum e.i.r.p. is valid for urban, suburban and rural areas.

In Paragraph 313 of the FNPRM the Commission proposes an upper e.i.r.p. limit of 1640 watts for "all areas on tall manmade structures and natural formations adjacent to bodies of water or unpopulated areas." This is approximately 50 dB more e.i.r.p. than a typical MVDDS site. The clear intent is to allow better MVDDS coverage in areas that do not and cannot contain DBS receivers. However, the unpopulated area is unspecified in extent, and it may be possible for such a high powered transmitter to interfere with distant DBS receivers outside the unpopulated area. In this situation the interference may conceivably affect many DBS receivers. Therefore, Pegasus recommends that the PFD of such a station be limited in the areas encompassed by any DBS receivers. Pegasus proposes that the PFD correspond to that caused by an e.i.r.p. of 12.5 dBm at a distance of 2 kilometers. In a 500 MHz band the PFD is equal to -181.5 $dBw/M^2/MHz$.

This assures that any required mitigation will be similar to that required of a typical MVDDS system.

2. MVDDS Antenna Requirements

The MVDDS system must cause limited interference to DBS receivers which are close to an MVDDS transmitter site, in the range of zero to approximately 1 kilometer. This is accomplished by adjusting the height of the MVDDS antenna relative to the close-in DBS receivers and by controlling the vertical beamwidth and sidelobe levels and vertical beam tilt.

For the purpose of mitigation of interference, the MVDDS antenna height must be measured relative to the height of surrounding DBS receivers. Height above average terrain ("HAAT") is of no significance because there is no MVDDS antenna sidelobe suppression if both the MVDDS transmitting antenna and nearby DBS receivers are at the same height, i.e. are on the same or nearby roofs. The MVDDS transmitting antenna height, for the purposes of mitigation, should be measured relative to a defined plane, called herein the "DBS plane," which is the highest plane that contains close-in DBS receivers or might contain close-in DBS receivers. For example, if the MVDDS antenna height above the DBS plane is 100 meters and the vertical beamwidth of the MVDDS antenna is 16 degrees, then the PFD can be controlled and limited out to a range of approximately 700 meters, the point where the 3 dB vertical beamwidth intersects the plane. If the vertical beamwidth is 5 degrees then the 3 dB vertical beamwidth intersects the plane at 2.3 kilometers. At this 3 dB point and beyond, a DBS subscriber is in the main beam of the MVDDS antenna. From this 3 dB point inward toward the MVDDS antenna, the MVDDS transmitting antenna vertical pattern can be controlled so that the PFD is almost constant up to the MVDDS tower. Antenna tilt can be used to optimize the result. Thus, the ability of an MVDDS system to control interference is strongly related to the vertical beamwidth of its transmitting antenna. Pegasus plans to use narrow vertical beams in order to minimize interference to DBS.

A typical pattern is given in Appendix 5, Figure 3 of Reference 1 (Reference 1 is "Progress Report, Northpoint-DBS Compatibility Tests, Washington, D.C.," October 1999). This figure depicts a rapid increase in signal strength (due to $1/4\pi R^2$) due to spreading and the decrease in signal strength provided by close-in compensation by the transmitting antenna's vertical beamwidth and sidelobe pattern. At 1 Km the antenna provides partial compensation; at 0.25 Km the antenna overcompensates and actually reduces the signal strength. Figure 4 (Reference 1) shows the effect of tilt on the close-in pattern, indicating the effectiveness of the combination of antenna height, tilt and narrow vertical beamwidth in limiting the MVDDS signal strength in the vicinity of its antenna. In fact, Figure 4 demonstrates overcompensation, resulting in an actual decrease in received signal strength near the MVDDS antenna. Figure 4 also shows a maximum discrimination value of 10 dB as the tilt is varied from 0 to 5 degrees, for a 150 meter antenna height. Pegasus has examined a variety of antennas, such as horns and planar arrays, in conjunction with various antenna tilts and heights and believes that antennas having the requisite characteristics are readily available. Pegasus' MVDDS technology is based on these narrower vertical beamwidths.

3. MVDDS Transmitting Antenna Azimuth

Because the DBS antennas are pointed in a general southerly direction if the MVDDS transmitting antenna also is pointing generally southerly, the MVDDS transmitting antenna radiation will illuminate the backside of the DBS antennas where they have, generally, the lowest gain.

However, the "southerly" direction is too broad since the MVDDS transmitting antenna horizontal beamwidth is of the order of 100 degrees. The U.S. orbital locations from 61.5W to 119W cause a wide range in DBS antenna azimuths in the same region, creating the possibility that an MVDDS transmitter will radiate into the front side of a DBS antenna, near the bore site, making the mitigation excessive. The maximum isolation, and the minimum mitigation and inconvenience to the consumer, occur when the MVDDS radiation is directed along the average of the two extreme DBS azimuths in the region of an MVDDS transmitter. There can be some leeway in the MVDDS transmitting antenna azimuth provided an MVDDS transmitter does not radiate into the front side of any DBS antenna close to the main beam.

B. Mitigation Process

1. Mitigation General Requirements

The field tests performed by Northpoint, DirecTV, EchoStar, and others, to evaluate the possibility of DBS sharing were based on the MVDDS operating requirements described in Section A, above. MVDDS system design must minimize the need for mitigation to DBS subscribers, that is, it must result in the following:

1) Affect the minimum number of DBS receivers;
2) Use of practical mitigation techniques consistent with a consumer product (the possible improvements in DBS receiver isolation are limited to improved antennas and shielding);
3) Mitigation capable of being implemented by local technicians/mechanics, otherwise the mitigation costs will be prohibitive; and
4) Mitigation generally acceptable to the DBS consumer, that is, the antenna installation after mitigation must be similar in size and appearance to its predecessor.

DBS antennas, which were designed as consumer products, were not designed to suppress interference. Interference was never seriously contemplated in the DBS design process because DBS was primary in the band 12.2-12.7 GHz in the United States. The antenna size was reduced so that its aesthetic appearance would be acceptable to consumers, an important competitive issue relative to cable. Further, the antenna is typically mounted on the dwelling in an unobtrusive location selected by the consumer with the advice of the installing technician/mechanic. The consumer service limits the available mitigation remedies.

A better antenna of approximately 50 to 55 centimeters may suppress the interference an additional 10 to 15 dB. External shielding of the same approximate size as the DBS antenna may add another 10 to 15 dB. The dwelling itself may not be a useful shield if made of wood or plastic, as is typical in rural areas. Large shields or large antennas, or peculiar looking antennas, will be aesthetically unacceptable to the subscriber. Moving the antenna to another location, even if effective because the building provides shielding, means moving the antenna to a location not favored by the consumer, to say nothing of adding more holes to the consumer's residence. Thus, the mitigation remedies are modest and limited. Consequently, it is important that the design of an MVDDS system be such as to result in these modest remedies being effective, meaning that the MVDDS operational requirements cited herein and in Section I of Pegasus' Comments are necessary wherever DBS subscribers may receive interference.

If mitigation cannot be accomplished using mitigation techniques consistent with a consumer's residence, then the MVDDS licensee must redesign his system and must not be allowed to operate until the mitigation process is successfully completed.

2. Sharing Model

In Paragraph 272 of the FNPRM the FCC refers to its sharing model described in Appendices H & I. This model provides a method for computing potentially harmful interference received by DBS receivers due to MVDDS operation. In each region, for each service (DirecTV or EchoStar) the result is a minimum permissible value of interfering C/I corresponding to an acceptable increase in receiver unavailability due to rain. This interfering C/I can be converted into the maximum permissible PFD at a DBS receiver. PFD is a parameter that can be conveniently measured in the field, by a local technician/mechanic, an agent of the local MVDDS operator, or by an agent of the local DBS service provider.

The mitigation is a local activity because each MVDDS system, within its environment, will be different. Also, the overall DBS performance varies from place to place due to variations in satellite e.i.r.p., local rain statistics, subscriber antenna alignment and elevation, crosspol rejection, adjacent satellite interference, etc., and whether the service is that of DirecTV or EchoStar. Replacement satellites with somewhat different characteristics also will be introduced from time to time by the DBS satellite operators. Therefore, the interference issues should be addressed for each individual MVDDS system involving the affected DBS service providers in that region.

The standardized link calculations recommended by the Commission in Appendices H and I of the FNPRM need to be presented for approximately twenty locations scattered around the U.S. For a given region, the Commission's published characteristics (presumably as part of the service rules) nearest the defined region would be used by the Local MVDDS applicant/licensee and the affected DBS service providers for the purpose of conducting the coordination and mitigation. Pegasus endorses the approach proposed by the Commission in Appendices H and I of the FNPRM.

Pegasus supports the methodology proposed by the FCC (see FNPRM at Paragraphs 268 and 269) and developed by the ITU-R for interference to DBS from NGSO FSS systems, to whit, an increase in rain unavailability of 2.86% for any one NGSO system and 10% for all NGSO systems. This rule, after much negotiation amongst the contending parties, was approved as reasonably fair to both parties, the DBS and NGSO FSS operators. Pegasus believes that this same criteria, developed for sharing between DBS and MVDDS systems is, therefore, demonstrably fair to both parties. This criteria can be readily converted into a C/I, RSSI or PFD defining a mitigation zone around each potential MVDDS transmitter within which mitigation may be required and without which mitigation will not be required. Since multiple MVDDS systems may be implemented in specific areas, the total increase in unavailability due to both NGSO and MVDDS operation may achieve 20% of the total, which is already a significant potential increase in unavailability. Pegasus respectfully urges the Commission not to extend the DBS unavailability beyond 2.86% for any one MVDDS operator and no more than 10% for all MVDDS operators operating in a region.

Further, Pegasus advocates the same 2.86% per MVDDS system for each climate region on the basis that subscribers in each rain zone have become either accustomed or resigned to the rain outages in their community and have largely accepted these as characteristic of their DBS service.

In Paragraph 270 of the FNPRM the Commission also considers a fixed annual increase in availability, such as 30 minutes, to each subscriber. For the reasons cited above this criteria can have detrimental effects on subscribers in light rain areas. If the outage in minutes is reasonable to subscribers in heavy rain areas of the southeast then the outage to subscribers in the lighter rain areas will be substantial relative to current experience, perhaps even increasing churn. If, on the other hand, the outage in minutes is reasonable in light rain areas, then the increase in unavailability in rainy areas will be negligible, unnecessarily enlarging the mitigation zone and penalizing MVDDS systems. Pegasus can find no advantage to determining outages in this manner. The percentage increase in unavailability, advocated by the Commission, affects each DBS subscriber in the same way, relative to his experience with DBS outages.

3. Coordinating Parties

Pegasus advocates, in Section I.B. of its Comments, that the coordination and mitigation be accomplished between the individual MVDD operator and the affected DBS service providers. Both parties have the technical capability to accomplish the coordination and mitigation quickly, at lowest cost, and with a minimum inconvenience to the DBS consumer. Each DBS service provider knows the location of each subscriber and has, for technical support, arrangements with local technicians/mechanics trained in the installation and maintenance of DBS systems and carrying the requisite insurance. Thus, the affected DBS service provider accomplishes the mitigation on behalf of its customer.

Requiring coordination between the individual MVDDS operator and the DBS consumer will cause only confusion to the consumer who is not likely to understand the issues. Further, the MVDDS and DBS services may be highly competitive since both offer similar services in the same regions. It is highly undesirable that the MVDDS operator and his agents interface directly with DBS consumers. Pegasus believes there is no way that this process will have a happy ending for either the DBS consumer or the consumer's DBS service provider. In essence, we cannot leave the consumer to fend for himself with a more technically superior and better financed MVDDS operator. It is the DBS customer's service provider who has the skills to determine the need for mitigation and who then can work out the coordination and mitigation with the cooperation of the local MVDDS operator. Thus, the mitigation process advocated by Pegasus promotes cooperation and direct communication between the MVDDS operator and the affected DBS service providers, making the best economic use of the DBS service provider's local technician/mechanic to accomplish the actual mitigation under instructions of the DBS service provider.

4. **Mitigation Techniques**

Pegasus, in Section I.B. of its Comments, proposes a coordination and mitigation process which involves an affected DBS service provider establishing which DBS receivers possibly require mitigation based on information contained in an MVDDS license application placed on notice. The initial coordination and mitigation occurs before the MVDDS licensee is authorized to operate and an affected DBS service provider does not know whether the path from a given DBS receiver to the potential MVDDS site is blocked (by buildings, foliate, etc.). In Section I.B. the MVDDS notice describes the radiation characteristics of the proposed MVDDS system. The service provider then calculates the potential interference based on line-of-sight conditions.

The example given by DirecTV (Reference 2) is an interfering C/I = 27.2 dB, corresponding to an increase in unavailability of 2.86%. See Appendix A, Figure 1 (Reference 2). Table 3 (ibid) for the 2.86% increase in unavailability tabulates a carrier PFD of -111.1 dbw/m^2 corresponding to a carrier power at the antenna output terminals of -120.6 dBW. The difference in these two numbers is the effective antenna aperture, -9.5 dB. The aperture also may be derived by considering a 45 centimeter antenna with an efficiency of 70%. The MVDDS signal then may, in this example, be no more than -147.8 dBW, i.e., 27.2 dB less.

Figures 6.2.1-1a, b, c and d (Reference 2) describe the horizontal pattern of a typical DirecTV antenna for various elevations (expressed as degrees of longitudinal separation between the satellite and DBS antenna of 1 to 65 degrees). Over this range of longitude the DBS antenna exhibits a frontlobe, sidelobes and backlobes of varying levels with approximately 3 dBi being the maximum value. The maximum value may not be applicable in a particular situation since this lobe is in the forward direction of the antenna at low elevation angles which cannot receive interference if MVDDS antennas are oriented southward. Therefore, the gain and the MVDDS interfering signal level can be computed for the geometric path in the direction of the MVDDS transmitter, using the specific gain of the DBS antenna in that direction.

This computation is approximate because blockage in the path is not yet known and the cited antenna patterns are taken in free space without any surrounding objects. When a DBS antenna is attached to a house or building, the sidelobes in particular can be significantly altered in level and direction. For example, a parapet or roof may intercept and reflect the forward lobe while not interfering with the main lobe of the antenna. Nevertheless, this example is only illustrative.

The ratio of the main lobe to maximum sidelobe gain is 34 - 3 = 31 dB, which is the ratio by which the antenna aperture in the sidelobe direction will be reduced. Therefore, the aperture corresponding to the sidelobe gain of 3 dBi is - 40.5 dB and the PFD defining the mitigation zone is -147.8 dBW-(-40.5 dB) = -107.3 dBW/m^2 , or –181 dB/M^2/MHz for a 24 MHz bandwith. This corresponds, for a 12.5 dBm MVDDS e.i.r.p., and a 500MHz bandwith, to a mitigation zone range of approximately 3 Km. This does not mean that every DBS antenna within the mitigation zone will receive harmful interference but only that each of these DBS antennas must be examined. The mitigation zone also will be smaller if the particular interfering C/I is less. This estimate illustrates that the mitigation zone can be quite large and that the DBS antenna sidelobe levels can be used in a first estimate of potential interference. The actual mitigation zone will be irregular because of the wide range in antenna gain in the sidelobe region, perhaps approximately 15 to 20 dB, depending on the azimuth to the MVDDS site or sites.

After identifying the DBS receivers potentially requiring mitigation, each such site is then visited by the DBS service provider's local agents who, by compass, can determine the azimuth to the MVDDS transmitter in order to evaluate the blockage in this path. If there is blockage, the agent simply leaves; no action is required. If there is no blockage, or if the blockage is uncertain, the agent installs a shield, or replaces the antenna with an antenna having better sidelobe characteristics or resorts to relocating the antenna. In severe interference conditions all three methods may be used.

Pegasus believes that this process will be successful in the majority of cases. However, the actual situation may be different once the MVDDS system becomes operational. At this time a spot check of the more marginal cases will confirm that the mitigation is successful or otherwise lead to a completion of the mitigation. Thus, several visits to particular sites may be necessary. As explained in subsection 7, below, the MVDDS operator will reimburse the DBS operator for any costs associated with the mitigation measures.

5. Mitigation Possibilities

The available mitigation techniques offer limited benefit if the DBS installation after mitigation is to remain aesthetically acceptable to the consumer. One simple remedy is to replace the 45 cm antenna with a 50 or 55 cm antenna, using the same feed, resulting in approximately the same gain and noise temperature but with better shielding. Pegasus believes this kind of antenna may have approximately 10 dB better sidelobes by eliminating the spillover backlobes characteristic of the present DBS antennas. Shielding of dimensions comparable to the DBS antenna also will provide roughly 10 dB to 15 dB more isolation. Larger and more effective shields may be aesthetically objectionable. For example, substantial costs have been incurred in the space segment in order to limit the size of the DBS antenna to approximately 45 centimeters so that the antenna is acceptable to the consumer. Any shield or antenna substantially greater than 45 cm may be objectionable to the consumer. Relocating the antenna so that the house or building intercepts the MVDDS signal may not be effective in rural areas where Pegasus provides its service. These structures typically are made of wood or plastic, which results in minimal shielding, perhaps only several dB. Residential shielding may be better with aluminum siding or stucco, which adheres to a metal wire mesh. Consequently, building shielding in rural areas may be the least effective and least desirable of the three methods.

The lack of powerful mitigation remedies requires that the mitigation in dB be limited. Lacking actual isolation measurements for shields and improved antennas generally acceptable to consumers requires a conservative approach, which Pegasus has defined in its proposed service rules. However, in order to provide more flexibility in MVDDS system design, Pegasus recommends that MVDDS service applications and the applicable notices contain information on improved shields and antennas which can be used in the mitigation process. Assuming both the shields and improved antennas will be acceptable to consumers and the antennas will have the requisite performance, both parties, the MVDDS operator and the affected DBS service providers, will then benefit in a quicker, more certain mitigation process.

An estimate of expected, reasonable antenna improvements can be provided by experience with the FSS which employs antennas as small as approximately 1 meter. The FCC has defined (see 47 C.F.R. §25.209) the antenna standard for FSS antennas in the far sidelobes to be $32 - 25\text{Log}\theta$, which, for gain = -10 dBi, $\theta = 48$ degrees. This is assumed to be the standard obtainable from a larger DBS antenna designed to suppress interference. This antenna offers a 13 dB improvement over the performance of a DBS antenna for the peak sidelobe case (peak sidelobe of DBS antenna = +3 dBi). At $\theta = 48$ degrees, the 25.209 antenna has reached the -10 dBi level. Pegasus' proposed definition of acceptable MVDDS antenna azimuths in Section I.A.3 of its Comments is based, in part, on this standard.

Improvements due to mitigation are estimated conservatively to be 13 dB for improved antenna (+3 dBi maximum DBS sidelobe to -10 dBi) and 10 dB for shielding for a total of 23 dB. If the C/I calculated for a given situation corresponding to a 2.86% unavailability due to rain is, for example, 22 dB, then the allowable worst case mitigation circumstance is when the C/I is calculated to be 22 - 23 dB = -1 dB. According to the mitigation process described in Section I.B. of Pegasus' Comments, if the calculated interfering C/I turns out to be -1 dB or less and there is no blockage in the path to the MVDDS transmitter then the MVDDS operator either must re-design his system or offer better mitigation materials (better shield or better antenna).

6. MVDDS Notice

As part of the mitigation process identified in Section I.B. of Pegasus' Comments, before an MVDDS facility commences operating, it must provide notice, enabling the affected DBS service providers to initiate their mitigation analysis and to develop a mitigation plan. To enable this process, the notice shall contain at least the following information:

(1) Address/telephone number of MVDDS operator and technical contact;
(2) Location of each MVDDS transmitter in latitude and longitude;
(3) Azimuth of the transmitter antenna;
(4) Antenna height above the DBS plane (via a physical survey of the area);
(5) Antenna tilt, vertical & horizontal beamwidths and patterns, 360 degrees around the antenna;
(6) Graphical illustration of the mitigation zone;
(7) All other data necessary to compute the mitigation zone; and
(8) Calculated PFD, in the DBS plane, out to the mitigation zone radius as proposed by the MVDDS operator for that region defined by the C/I corresponding to the 2.86% increase in DBS unavailability.

This is tentative since not all DBS sites or potential DBS sites will be discernible in the survey.

7. Mitigation Payment

The DBS service provider shall bill the appropriate MVDDS operator for mitigation costs, both labor and materials. The DBS service provider shall, in turn, appropriately reimburse the local DBS service provider's technician/mechanic for his mitigation services. For instance, each visit to a subscriber's premises may be billed at approximately $150, plus materials, which will ultimately be paid by the MVDDS operator. In addition, the MVDDS operator will be billed for the cost of all mitigation materials used, such as antennas, shields and brackets, plus shipping and handling. As described herein, some DBS sites may require several visits.

8. Alternative Mitigation Methods

In Paragraph 271 of the FNPRM the Commission considers instigating mitigation procedures only if a subscriber complains. However, the subscriber has no way of measuring or calculating the increased unavailability due to MVDDS interference and may not even understand the relationship between interference and rain outages. Often, a subscriber will not complain at all but will simply change service, i.e., change to a cable system, a phenomenon called churn, which is particularly deleterious to DBS. This will be particularly true if there are no criteria limiting interference, and if the interference is very large. The DBS service providers must have the opportunity to maintain the quality of service which has already proven to be a success for DBS in the market place. To leave interference detection or mitigation in the hands of only a consumer is a prescription for disaster. In mitigating interference the local MVDDS operator must deal with a professional counterpart, such as the DBS service provider, so that the service quality is maintained and the subscriber suffers the least inconvenience and confusion.

C. MVDDS System Operation and MVDDS/NGSO FSS Sharing

Pegasus has filed an application to become a licensee of MVDDS systems. The FNPRM has touched on several issues affecting MVDDS operation which Pegasus addresses in the following sections.

1. MVDDS System Power Control

In the FNPRM at Paragraph 216 the Commission cites "reducing the power of their (MVDDS) transmitters during periods of DBS fading due to rain..." as a potential method for further mitigating interference. Pegasus believes this method may have some merit, but it is not necessary that it be contained in the service rules. This method is not as effective as the other methods proposed by Pegasus and others, as described herein. Also, the assumption that the two rain fades, MVDDS and DBS, are not simultaneous is a good assumption, but not always true. In addition, monitoring rain fade and providing transmitter power control adds to the cost of providing an MVDDS service, which will not be required in all cases. Instead, Pegasus suggests that this method may be considered at their option by potential MVDDS operators in particular situations where this added measure may be needed or useful. Power control should not be required by the Commission's MVDDS service rules.

2. Sharing Between MVDDS and NGSO FSS, 12.2-12.7 GHz Band

The present FNPRM, which considers sharing between MVDDS and DBS, exemplifies a trend toward more sharing. Sharing costs money and inconvenience but makes fuller use of spectrum which is in growing short supply. Sharing between NGSO FSS and MVDDS obviously is required and is equally painful to the participants but equally advantageous.

a. Interference From NGSO FSS

MVDDS systems, such as proposed by Pegasus, are protected from NGSO FSS interference by the Commission's proposed PFD limit of -150 dBW/m^2/4KHz for angles from 0 to 5 degrees. In addition, NGSO FSS systems are constrained to meet the unavailability requirement for DBS, namely 2.86% increase in unavailability due to rain for any one NGSO FSS operator and 10% for all. After much negotiation by the parties, this requirement has been adopted as fair to both the DBS and NGSO FSS parties.

The DBS and MVDDS systems have similar G/Ts and similar modulation, coding, multiplexing and channel plans. Both antennas point at the sky where most NGSO systems will have satellites. Consequently, if the NGSO interference is acceptable to DBS it must be acceptable to MVDDS. If anything, the low elevation angle of the MVDDS antennas will result in more terrain blockage. Therefore, Pegasus believes the proposed PFD limit and unavailability limit are adequate to protect both DBS and MVDDS.

b. Interference To NGSO FSS

MVDDS is a low power, cellular Fixed Service system with significant design constraints to limit interference to ubiquitous DBS receivers. Therefore, an MVDDS system will cause less interference than many other Fixed Service systems, such as LMDS. Any NGSO FSS terminal located in the vicinity may experience harmful interference. However, just as in DBS coordination, a shield obstructing the path to the MVDDS transmitter, or a better antenna, likely will be sufficient.

In addition, NGSO system earth stations operate dynamically, acquiring a satellite, tracking it and then handing it over to the succeeding satellite. In addition, NGSO terminals operate dynamically in order to avoid interference from the satellites of other NGSO operators, terrain obstacles such as buildings and trees, and interference from GSO satellites. Consequently, avoiding a nearby MVDDS transmitter site, if shielding is not adequate, would not seem to be a great hardship if the NGSO FSS terminal elevation angle alone is not adequate.

c. Coordination Procedures

A coordination procedure similar to that proposed by Pegasus herein for DBS-MVDDS coordination also would seem to suffice to MVDDS-NGSO FSS coordination. For example, the MVDDS applicant's commencement of service notice, would alert NGSO operators to begin a mitigation process that would protect NGSO systems from unusual MVDDS system designs.

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Technical Certification

I, John Kiesling, Consulting Engineer to Pegasus Broadband Corporation, hereby certify the following under penalty of perjury:

I have reviewed the foregoing "Comments of Pegasus Broadband Corporation" and "Technical Supplement to Comments of Pegasus Broadband Corporation." The technical information contained in those documents are true and correct to the best of my knowledge.

John Kiesling

Dated: March 12, 2001